

U.S. Land Port of Entry

Project Overview

*View Looking West Toward
Outbound and Secondary
Inspection - Photo Credit:
Paul Crosby*

Located along the Minnesota-Canadian border the Warroad Land Port of Entry is a 40,108-square-foot facility that supports the mission-driven demands of U.S. Customs and Border Protection (CBP), the federal agency responsible for securing the nation's borders and promoting legal trade and travel. The facility is composed of three distinctly functioning buildings united by a continuous canopy that manages a complex set of operational issues including site circulation of commercial, private, and recreational vehicles and state-of-the-art vehicle inspections. The main building serves as the public interface, the officer work and training area and the secure holding cell area of the facility. The secondary building is used for enclosed vehicle inspections and houses the firing range. Finally, the commercial building allows for complete unloading and inspections of semi-trucks.

The 19-acre site is surrounded by and located in a wetland and thus presented unique construction and environmental challenges. The entire building is supported by friction piles and the site required geo-engineered fill and fabric.

In addition to meeting these programmatic and operational issues, the port must also stand as a gateway to our nation, representing the open and democratic values of transparency, dignity, fairness and humaneness of our federal government.

Location:

State Highway 313
Warroad Minnesota 56763
United States

Project Owner:

United States General Services Administration (GSA)

Submitting Architect:

Snow Kreilich Architects, Inc.

Project Completion Date:

February, 2010

Project Site:

Previously Undeveloped Land

Project Type:

Public Safety – General

Project Site Context/Setting:

Rural

Other Building Description:

New

Building or Project Gross Floor Area:

40,108 square feet

BOMA Floor area method used?:

No

Hours of Operation:

24/7/365

Total project cost at time of completion, land excluded:

\$30,000,000.00

Design & Innovation

Approach - Photo Credit: Paul Crosby

Sustainability Diagram - Photo Credit: Julie Snow Architects, Inc.

Vehicle Circulation Diagram - Photo Credit: Julie Snow Architects, Inc.

This project required a constant balance of meeting the programmatic and security requirements of a LPOE with the delicate environmental issues of building in a wetland. Vehicle turning radii and inspection areas demanded large areas of space yet respecting the site meant minimizing that footprint. Wetlands were constructed to manage and treat surface run-off and the building layout was designed to minimize the overall footprint. Siting,

orientation, building form, envelope and structural and mechanical systems were all influenced by these challenges.

Climate was an additional challenge on this site. Orienting the building to maximize protection from NW winter winds created a micro-climate for officers to perform outdoor operations. Inspection canopies were stretched beyond their program requirements to link all three buildings and create solar shading. External insulation and a rain screen application of the cedar siding produced a durable and energy efficient envelope.

Wetlands were preserved and reconstructed on the site to minimize the projects overall impact on the ecology of the site. Existing tree groves were considered in the orientation and placement of the building to minimize NW winter winds and the building and canopy further created micro-climates to address the harsh winter climate.

Regional/Community Design

Regional Identity - Photo
Credit: Frank Ooms

Logging Culture - Photo
Credit: Corbis

*Christian Bros. Wood Hockey
Sticks - Photo Credit:
Warroad Historical Society*

Conceived as a specific response to the vast open landscape along the Minnesota-Canadian border, the port's form reiterates the dominant horizon of the landscape while making reference to the East-West border. To create a strong regional identity, the exterior is clad in a black stained cedar while the inspection areas and thresholds that users pass through are rendered with a warm "heartwood".

Northern Minnesota has a long history of wood culture and construction. The town of Warroad began as a milling town and is home to Marvin Wood Windows, and Christian wood hockey sticks. As we began exploring appropriate and sustainable material options for the interior and exterior finishes these ideas, the local labor pool's familiarity with wood construction and strong cultural ties to the region lead to the selection of a building wrapped completely in cedar wood siding.

With a building population of 10 staff, and a peak of 30 transient visitors, and the necessary remote location of the Border Station, there is little infrastructure to serve alternative transportation. However, to serve as an incentive to alternative transportation, preferred parking for efficient vehicles (5%), preferred parking for carpooling (5%) as well as bicycle parking and shower facilities are provided.

Metrics

Estimated percent of occupants using public transit, cycling or walking:

0%

Land Use & Site Ecology

*Site and Surrounding
Ecosystems - Photo Credit:*

*Native Plantings - Photo
Credit: Frank Ooms*

*Tree Plantings - Photo Credit:
Frank Ooms*

Located in and around a wetland bog, wetland restoration and storm water run-off were critical design considerations.

Restoration was achieved through native and/or adaptive plantings. The plantings include American Larch, Whitespire Birch, a native upland meadow prairie mix, a native mesic meadow prairie mix, and a native wet meadow mix. Water filtration ponds captured site run off and utilize tall grasses, native sedges, and forbes that will slow the flow of water and allow it to infiltrate the ground via a deep root system. Native prairie mixes were seeded throughout the site and comprise the majority of landscape plantings.

The American Larch and Birch are planted in rows across the entire site with gaps and interruptions for critical views and functions. These planting create a buffer for wind and snow and provide shelter for local fauna. Additionally all vegetation celebrates the dynamic seasonal changes of the region.

Locally sourced stone from Virginia, MN was utilized throughout the landscape to provide vehicle barriers against the building for security reasons but also aided in the filtration of storm water run off. Native Sedum was also planted into the stone flagging areas to provide seasonal interest and water filtration.

Bioclimatic Design

Geothermal System

*Diagram - Photo Credit: Julie
Snow Architects, Inc.*

Site Orientation and Wind

*Pattern - Photo Credit: Julie
Snow Architects, Inc.*

The orientation of the building and site were established to maximize solar heat gain in the winter and reduce vulnerability to harsh winter conditions. Since officers spend equal time indoors and out year-round, creating a micro-climate that protected the officers was mission critical.

The buildings were set on the edge of an existing tree grove to minimize the northwestern winter winds prevalent to the area. Additional tree rows were planted to reinforce existing wind break. Main and commercial buildings were stretched across the northern edge of the site providing protection to the outdoor inspection areas.

East-west orientation also maximized solar heat gain in the winter while minimizing solar heat gain in the summer with a large canopy. The canopy links all three buildings together creating a protective environment for officers to move between buildings in the harshest climates. The geometries and angles of the building were influenced by both solar orientation and traffic flow.

The geothermal system minimizes non-renewable energy resources while radiant in-floor heating maximizes comfort and reduces the need to fully heat the volume of the building. Warehouse and other portions of the building that aren't constantly occupied are climatically controlled by HVAC systems tied to occupancy sensors.

Light & Air

*Connection to the Outdoors -
Photo Credit: Paul Crosby*

*Sightlines Diagram - Photo
Credit: Julie Snow Architects,
Inc.*

*Wall Section - Photo Credit:
Julie Snow Architects, Inc.*

Security and officer comfort were the design drivers to create a facility with day lit interiors and panoramic views. Security through surveillance was a mission critical objective that inspired an officer area with views to 90% of the site and inspection zones.

Glazing surrounded three sides of the work area and every office and work space had access to views and natural light. The ceiling plane and material were continuous from the interior to the exterior, further emphasizing the connection between the interiors and exterior.

In secured areas that are required to be visually separated for inspection we utilized tubular skylights to provide natural daylight to these spaces. This achieved an average illuminance of over 30 footcandles throughout the usable area of the spaces.

Due to strict security requirements, operable windows were not allowed and all spaces were required to be negatively pressurized. To assure indoor air quality Air-to-air heat exchangers were included in the design to capture the heat of rejected relief air, and to temper the incoming ventilation air, thus reducing energy consumption. The main building utilizes a dedicated outside air unit, which provides pre-conditioned ventilation air to constant volume heat pump units.

Metrics

Daylighting at levels that allow lights to be off during daylight hours:

91%

Views to the Outdoors:

93%

Within 15 feet of an operable window:

0%

Water Cycle

*Water Flow Diagram - Photo
Credit: Julie Snow Architects,
Inc.*

*Rainwater Collection System
Diagram - Photo Credit: Julie*

Snow Architects, Inc.

*Reconstructed Wetland -
Photo Credit: Frank Ooms*

The site was designed using strategies intended to improve the performance of water efficiency, maintenance, stewardship of resources, and energy savings. The site design addresses water quality and quantity of water through a layered system of infiltration areas and reconstructed wetlands. As rain events occur, runoff flows over the impervious surfaces of the property and into one of several water treatment mechanisms. Each treatment area is designed to slow, infiltrate, and filter water movement by trapping hydrocarbons, heavy metals, and other chemical by-products from vehicular traffic.

The choice of native plant materials eliminates ongoing maintenance, with exception of the first two years where reseeding and fertilization is needed to establish a solid cover of plants. A temporary irrigation system was installed for the tree and garden plantings only and is decommissioned after 2 years.

The facility reduces potable water usage through low-flow fixtures, as well as utilizing a rainwater reclamation system. The project utilizes dual flush toilets in all men's, women's, and unisex restrooms. Sink aerators and flow restrictions on shower heads help to reduce flow usage. On the supply side, two rainwater reclamation systems have been installed, each providing recycled, treated water to flush water closets and urinals.

Metrics

Percent reduction of regulated potable water:

92%

Is potable water used for irrigation:

No

Percent of rainwater from maximum anticipated 24 hour, 2-year storm event that can be managed onsite:

90%

Energy Flows & Energy Future

*Sustainability Diagram - Photo
Credit: Julie Snow Architect,
Inc.*

*Solar Shading Diagram -
Photo Credit: Julie Snow
Architects, Inc.*

*Re-Used Cedar Siding Cut-
Offs - Photo Credit: Paul
Crosby*

As a LEED Gold Certified facility, enhanced commissioning optimized the HVAC performance, reducing the building's energy demand. Ground coupled heat exchange (geothermal) heating and cooling was utilized to reduce overall energy consumption of the entire facility and take advantage of the site's wet soil conditions. This heating source was paired with in-floor radiant heat to minimize the heating load but maximize the comfort of officers and visitors within the facility.

Maximizing solar gain in the cooler months while minimizing heat gain in summer were critical design consideration for the northern Minnesota location. The inspection canopies stretched over southern glazed areas doubling as solar shading for the windows.

Additional energy reducing strategies include water recovery systems, automated HVAC and lighting controls and ongoing wind power purchase agreements with the local energy cooperative. As a mission critical facility, "passive survivability" was critical and thus the port is able to operate for 72 hours off the grid.

Recycled and renewable materials were used throughout the facility. The exterior envelope which is wrapped in sustainably harvested cedar siding and the cut-offs from the exterior were saved and reused as the finish surface of the interior walls and millwork resulting in minimal waste of materials.

Metrics

Total pEUI:

193 kBtu/sf/yr

Net pEUI:

193 kBtu/sf/yr

Lighting Power Density:

1.31 watts/sf

Upload Energy Data Attachment:

[Warroad_LEED Submittal Package.pdf](#)

Materials & Construction

*Detail of Building Materials -
Photo Credit: Paul Crosby*

*Wall Section Diagram - Photo
Credit: Julie Snow Architects,
Inc.*

Material Consistency - Photo

Credit: Paul Crosby

Sustainably harvested cedar siding was used for the entire exterior envelope, some interior walls and ceilings and the public lobby millwork and 98% of all wood material on the project came from FSC Certified sources. Additionally 22% of the material content of the project came from recycled materials.

The National Institute of Standards and Technology (NIST) Life Cycle Cost Analysis software was used to determine the most energy efficient heating and cooling systems for this particular site based on available resources and costs. This ultimately informed the client of the benefit of a geothermal heating and cooling system in lieu of a more standard system.

Given the remote site of the project, the construction waste and recycling program utilized regional waste haulers as well as local businesses and craftsmen who could re-use construction waste materials. Materials were separated on-site and 80% (or 260 tons) of construction waste was diverted from landfill.

In collaboration with the building management team, the protocol for storage and collection on recyclables is to collect in each building, and then consolidate within the secondary building (area C) and then take out to the service yard for collection by the contracted waste management service.

Long Life, Loose Fit

Sight Lines Diagram - Photo

*Credit: Julie Snow Architects,
Inc.*

*Rain Screen Air Cavity
Diagram - Photo Credit: Julie
Snow Architects, Inc.*

The design team considered Life Cycle Cost Assessments, use of low maintenance materials, and the projects ability to adapt. As a Land Port of Entry, technology and security demands change. The port was designed to accommodate this known yet unquantifiable demand. The canopy houses race ways for future technology, eliminating the need to rebuild existing infrastructure. The inspection islands integrated additional conduit runs and access panels to allow for ease of change or additional inspection technology to be added.

The open office environment allows for change and adaptation over time as operations and staffing demands change. This open layout also enables the port to be operated with only 2 officers if needed, allowing views to all mission critical inspection areas from one location within the building. Life cycle cost assessments were conducted for many of the facilities systems including pervious paving, exterior siding, PV power, HVAC equipment and roof slope and material.

Due to proximity to wetlands, a critical design component was the siding of the port which was installed in a rain screen wall assembly, effectively extending the life of the wood siding, minimizing water damage to the exterior envelope and reducing pest infestation through maintaining a dry wall cavity.

Collective Wisdom & Feedback Loops

Energy modeling was an integral component of the design process that informed siting, openings, orientation, and wall assemblies. Our mechanical engineer utilized DOE-II energy modeling software to guide sustainable and energy reducing strategies throughout the process informing the design team in a collaborative and interactive process.

This project has received numerous awards and recognition for the sustainable design strategies including LEED Gold Certification, a national AIA honor award, a Design review award from Architect Magazine and a AIA MN honor award. We have shared lessons learned

with several national journals allowing others to learn from this projects achievements and challenges.

Our design team followed the GSA's total building commissioning guideline which requires that all building systems be commissioned. This includes the minimum systems required by LEED. We also reviewed and provided input on submittals relating to systems being commissioned during the construction phase. Additionally, the commissioning consultant was on site on several occasions to perform functional performance testing with assistance of the contractors. Several deficiencies were documented and tracked through resolution. The results of the commissioning process indicate that all systems are functioning per the owner's requirements and that all outstanding comments, issues, action items, and deficiencies have been resolved.

Other Information

Cost and Payback Analysis:

Early in the design process several energy options were explored including Electric, Electric Thermal Storage, Natural Gas, Propane, and Geothermal. They were evaluated based on LCCA, sustainability goals, local labor maintenance, security goals and overall longevity of systems. Extensive research and conversations were had between design team and client, balancing pros and cons of these systems. Ultimately, we choose and designed a geothermal heating and cooling system which reduced long term energy demands of the facility. It was a cost effective choice based on our clients 25 year Life Cycle requirement and also efficiently works with the radiant in-floor heat specified and snow melt requirements for the exterior inspection areas, lessening the demand for salting the site, minimizing the overall environmental impact to the surrounding wetlands.

ENERGY OPTIONS:

Electric: Initial cost = \$55,500 Life Cycle Cost = \$1,291,356

Electric Thermal Storage: Initial cost = \$159,020 Life Cycle Cost = \$808,347

Propane: Initial cost = \$192,800 Life Cycle Cost = \$1,129,394

Geothermal: Initial cost = \$325,500 Life Cycle Cost = \$718,877

Natural Gas: Initial cost = \$923,040 Life Cycle Cost = \$1,407,799

Process and Results:

The Warroad LPOE was part of the GSA's Design Excellence and Construction Excellence Programs. These programs entail three peer reviews during each of the Design and Construction phases. The peer reviews are comprehensive reviews, ranging from overall design quality, to sustainability, constructability, and cost management. The design cannot move from design to construction documentation if it does not pass the review of the Office of the Chief Architect of the United States. These peer reviews included all of the design disciplines, the GSA's project managements team, as well as the construction contractor. The program ensures a holistic design that is thoroughly vetted. Aside from project quality assurance, this review procedure created a list of lessons learned for the Client, Architect, and Contractor.

Rating System(s) Results:

Rating System:

LEED NC v2.2

Rating Date:

2011

Score or Rating

Result:

Gold

Additional Images

*Site Plan - Photo Credit: Julie
Snow Architects, Inc.*

*Labeled Plan with
Landscape - Photo Credit:
Julie Snow Architects, Inc.*

*Elevations - Photo Credit:
Julie Snow Architects, Inc.*

*North Facade - Photo Credit:
Frank Ooms*

*North Facade and Primary
Inspections - Photo Credit:
Paul Crosby*

*Primary Inspection Canopy -
Photo Credit: Paul Crosby*

*Secondary Inspection
Canopy - Photo Credit: Frank
Ooms*

*Secondary Canopy and Main
Public Entrance - Photo
Credit: Paul Crosby*

Project Team and Contact Information

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Project Team:

Role on Team	First Name	Last Name	Company	Location
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